

1                   CONFERENCE SYSTEM HAVING AN EMBEDDED WEB SERVER,  
2                   AND METHODS OF USE THEREOF

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5                   CROSS-REFERENCE TO RELATED APPLICATIONS

6                   This application claims the benefit of commonly owned  
7                   U.S. Provisional Patent Application No. 60/104,264 entitled  
8                   "Conferencing System Having Integrated Network Concentrator  
9                   and Embedded Server, and Methods of Use Thereof", filed on Oc-  
10                  tober 14, 1998. This application is also related to commonly  
11                  owned U.S. Provisional Patent Application No. 60/089,011, en-  
12                  titled "Videoconferencing System with Integrated Network  
13                  Server", filed on August 18, 1998 and now abandoned. The fore-  
14                  going applications are incorporated by reference.

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16                   BACKGROUND

17                  1. Field of the Invention

18                  The present invention relates generally to telecommunica-  
19                  tions systems, and more particularly to a web-enabled video-  
20                  conferencing system.

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1    2. Description of the Background Art

2         Conferencing systems, which enable real-time communica-  
3         tion between persons or groups of persons located remotely  
4         from each other, are becoming progressively widely utilized in  
5         commercial settings. In particular, many businesses (espe-  
6         cially those having geographically dispersed operations) em-  
7         ploy videoconferencing systems to facilitate group discussions  
8         or presentations and thereby avoid requiring all of the par-  
9         ticipants to travel to a central location. Such videoconfer-  
10        encing systems may additionally permit sharing of data, such  
11        as slides or other audiovisual content.

12        It is often desirable to connect communications devices  
13        to existing computer networks, such as local area networks  
14        (LANs). LANs advantageously enable sharing of files and appli-  
15        cations between network devices (such as PCs) and also facili-  
16        tate common use of peripheral devices, such as printers or mo-  
17        dems. Further, utilization of LANs enables centralized remote  
18        management of network devices by a system administrator.

19        Despite the inherent benefits of doing so, prior art  
20        conferencing systems have offered no or limited network con-  
21        nectivity. Of those conferencing systems capable of connecting  
22        to a LAN, many require expensive and difficult-to-configure  
23        add-on network interface hardware. An additional drawback as-  
24        sociated with prior art conferencing systems capable of being

1 coupled to a LAN is their lack of a standardized and familiar  
2 interface. Persons wishing to communicate with a conferencing  
3 system via the LAN install special software and acquaint them-  
4 selves with proprietary, non-intuitive interfaces developed by  
5 the conferencing system manufacturer. Such interfaces may not  
6 necessarily be compatible with other devices connected to the  
7 LAN.

8 In view of the foregoing discussion, there exists a need  
9 for a conferencing system which can be easily coupled to a  
10 LAN. There is a further need for a conferencing system which  
11 facilitates communication therewith via the LAN by utilizing a  
12 standard, well-known interface.

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SUMMARY OF THE INVENTION

2       The present invention generally comprises a conferencing  
3       system having an embedded web server. The web server may be  
4       advantageously utilized to retrieve, view and transmit slide  
5       presentations, and to remotely manage the associated  
6       conferencing system.

7       In a preferred embodiment of the invention, the  
8       conferencing system comprises a videoconferencing unit (VCU)  
9       configured to transmit images and speech of near conference  
10      participants to a remote conferencing device, and to receive  
11      images and speech of remote conference participants for pres-  
12      entation to the near conference participants. The VCU is pro-  
13      vided with a multi-port network concentrator, such as an  
14      Ethernet hub, allowing the VCU and at least one additional de-  
15      vice (typically a personal computer) to be connected to a LAN  
16      via a single physical connection. The VCU is additionally pro-  
17      vided with a network interface coupled to the network concen-  
18      trator to enable communication between the VCU and other de-  
19      vices coupled to the LAN.

20       The embedded web server is conventionally operative to  
21      serve web pages responsive to requests received from remote  
22      network devices over the LAN. In accordance with preferred em-  
23      bodiments of the invention, the web pages include scripts or  
24      applets for selecting slide presentations for subsequent

1 transmission by the VCU, for viewing slide presentations being  
2 transmitted by the VCU during a conference, and for performing  
3 remote management operations such as configuration and trou-  
4 bleshooting of the VCU, as well as call set-up. A user at a  
5 network device accesses the web pages by pointing a conven-  
6 tional browser to a URL uniquely identifying the VCU. The  
7 VCU's web server responsively transmits a web page setting  
8 forth variou's VCU-related options available to the user, such  
9 as viewing a presentation, selecting a presentation for trans-  
10 mision by the VCU, and performing remote management tasks.

11 Upon selection of a link corresponding to the desired option,  
12 the web server transmits a web page having a script or applet  
13 for effecting certain operations corresponding to the desired  
14 option. For example, the web page associated with the "presen-  
15 tation selection" option may include routines for generating a  
16 window enabling the user to identify a presentation (typically  
17 residing in the memory of the requesting remote network de-  
18 vice) for transmission by the VCU, and for sending the identi-  
19 fied presentation to the VCU over the LAN.

20 By utilizing an embedded web server, the videoconferenc-  
21 ing system of the present invention advantageously allows us-  
22 ers of remote network devices to easily communicate with the  
23 VCU through a well-known, familiar interface. Further, connec-  
24 tion of the VCU to the network permits access to conference

1 information by network device users, and allows conference  
2 participants to transmit and view presentations stored on net-  
3 work-connected computers. Finally, connection of the VCU to  
4 the network facilitates remote management of the VCU by a sys-  
5 tem administrator.

1                   BRIEF DESCRIPTIONS OF THE FIGURES

2               In the accompanying drawings:

3               FIG. 1 is a block diagram of a videoconferencing system  
4               of the present invention;

5               FIG. 2 is a block diagram showing contents of a memory of  
6               the FIG. 1 videoconferencing system;

7               FIG. 3 is a network diagram depicting in particular the  
8               interconnection of the videoconferencing system with remote  
9               conference endpoints and network devices;

10              FIG. 4 is an exemplary home page transmitted by an embed-  
11              ded web server of the videoconferencing system;

12              FIG. 5 is an exemplary web page displaying options for  
13              performing remote management tasks;

14              FIG. 6 is an exemplary web page displaying information  
15              relating to presentation selection;

16              FIG. 7 depicts a set of thumbnail images from a presenta-  
17              tion displayed on a video monitor of the videoconferencing  
18              system;

19              FIG. 8 is a flowchart showing steps of a method for se-  
20              lecting a presentation for distribution by the videoconferenc-  
21              ing system; and

22              FIG. 9 is a flowchart depicting steps of a method for  
23              performing remote diagnosis of the videoconferencing system.

1                   DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

2         FIG. 1 is a block diagram of a videoconferencing system  
3         100 according to the present invention. The videoconferencing  
4         system 200 includes a videoconferencing unit (hereinafter  
5         "VCU") 102 which receives input from and transmits output to a  
6         variety of peripheral devices, and additionally communicates  
7         with other devices, including remote conference endpoints and  
8         computers, via private or public networks. VCU 102 acquires  
9         video and audio information (typically representative of the  
10        images and speech of the near conferencing participants) re-  
11       spectively generated by at least one camera 104 and micro-  
12       phones 106. VCU 102 processes the acquired video and audio in-  
13       formation, and transmits the processed information to at least  
14       one remote conference endpoint connected to VCU 102 via ISDN  
15       lines 108.

16         VCU 102 simultaneously receives video and audio informa-  
17       tion (typically representative of the images and speech of the  
18       remote conference participants) from the remote conference  
19       endpoint. The received video and audio information is proc-  
20       essed by VCU 102 and the processed video and audio information  
21       is directed to a video monitor 110 and speakers 112 so as to  
22       present to the near conference participants the images and  
23       speech of the remote conference participants. The VCU 102 may  
24       also receive input from or direct output to other peripheral

1 devices, such as a videocassette player/recorder, document  
2 camera or LCD projector.

3 Incorporated within VCU 102 are a set of internal elec-  
4 tronic components interconnected for communication by at least  
5 one bus 114. The internal components include a central proc-  
6 essing unit (CPU) 116, an audio input/output interface 118, a  
7 video input/output interface 120, an ISDN interface 122, a  
8 memory 124, a network interface 126, a network hub 128, and a  
9 user controls interface 132. CPU 116 interprets and executes  
10 program instructions loaded from memory 124. Audio in-  
11 put/output interface 118 performs analog-to-digital and digi-  
12 tal-to-analog conversion and performs other signal processing  
13 tasks in connection with audio information received from mi-  
14 crophones 106 and sent to speakers 112. Similarly, video in-  
15 put/output interface converts and processes video information  
16 received from camera 104 and sent to video monitor 110.

17 ISDN interface 122 applies well-known processing opera-  
18 tions (such as inverse multiplexing) to audio and video data  
19 received or transmitted over ISDN lines 108. ISDN interface  
20 may include a set of ports for physically and electrically  
21 connecting ISDN lines 108 to VCU 102. Memory 124, which may  
22 variously include volatile RAM, non-volatile ROM, and/or stor-  
23 age devices such as magnetic disk drives or CD-ROMS, stores  
24 executable programs, data files and other information. The

1 contents of memory 124 will be discussed below in connection  
2 with FIG. 2.

3 Network interface 126 and network hub 128 enable connec-  
4 tion of VCU 102 to a local area network (LAN) 130. Network in-  
5 terface 126, which may comprise a conventional Ethernet card,  
6 mediates between VCU 102 and the physical connection to LAN  
7 130 in accordance with predetermined protocols. Network inter-  
8 face 126 is preferably connected to the internal port of net-  
9 work hub 128. Network hub 128 preferably comprises an Ethernet  
10 hub, but may alternatively comprise any network concentrator  
11 which physically or logically interconnects network devices.

12 Network hub 128 is provided with a plurality of external  
13 ports enabling connection thereof to LAN 130 and to at least  
14 one local network device, such as local personal computer (PC)  
15 132. While two external ports are shown in FIG. 1, those  
16 skilled in the art will recognize that network hub 128 may be  
17 provided with a greater number of external ports to enable  
18 connection to additional network devices. Electrical connec-  
19 tion of network hub 128 to LAN 130 and local PC 132 will typi-  
20 cally be accomplished using unshielded twisted pair or (thin  
21 or thick) coaxial cable. Network hub 128 may also be provided  
22 with conventional status indicators for presenting a visual  
23 indication to the user of the connection status of VCU 102 and  
24 PC 132 for diagnostic or monitoring purposes.

1       User controls interface 132 enables entry of user input  
2   from a local conference participant by receiving and process-  
3   ing signals received from user controls 134. According to one  
4   implementation of the invention, user controls 134 includes a  
5   conventional wireless remote control device having a set of  
6   keys engageable by the user. The keys may include numeric  
7   keys, directional arrows, volume and camera position adjust-  
8   ment keys, a menu key, and a slideshow key for initiating  
9   transmission of slideshow images to the remote conference end-  
10   point. Engagement of keys causes a corresponding infrared or  
11   radio frequency code to be sent to user controls interface  
12   132. User controls interface 132 is thus operative to receive  
13   and interpret the codes for further processing by other compo-  
14   nents of VCU 102. Entry of user input, such as telephone num-  
15   bers or configuration information, is advantageously accom-  
16   plished through use of a graphical user interface (GUI), dis-  
17   played on monitor 110, which prompts the user for specified  
18   information.

19       FIG. 2 is a block diagram showing various programs and  
20   files stored within memory 124. Contents of memory 124 include  
21   operation system (OS) 202, diagnostics/management module 204,  
22   conferencing application 206, presentation engine 208, web  
23   server 210, and web pages 212. OS 202 controls the allocation  
24   and usage of hardware resources such as CPU 116 and memory

1    124. Diagnostic/management module 204 is configured to perform  
2    diagnostic tests of VCU 102, determine and adjust VCU 102 con-  
3    figuration parameters, and conduct various other system man-  
4    agement tasks. Conferencing application 206 performs encod-  
5    ing/decoding, multiplexing/demultiplexing, signaling, error  
6    checking and related operations in connection with the commu-  
7    nication of audio and video data streams between VCU 102 and  
8    one or more remote conference endpoints. Presentation engine  
9    208 is operative to convert presentation slides encoded in a  
10   first format (such as slides created using the Microsoft  
11   Powerpoint application) to a second format suitable for trans-  
12   mission to remote conference endpoints. Presentation engine  
13   208 is further operative to enable user selection of individ-  
14   ual slides (from a collection of slides) for transmission to  
15   remote conference endpoints, and to transmit selected slides  
16   to PCs or other devices accessing VCU 102 through LAN 130 (the  
17   process of which will be described in further detail below).

18       Web server 210 comprises conventional server software for  
19   transmitting web pages 212 in response to requests received  
20   from remote PCs or other devices over LAN 130 (or from local  
21   PC 132). Web servers are well known in the art and hence will  
22   not be discussed in detail herein. Web pages 212 are typically  
23   encoded using hypertext markup language (HTML) and may contain  
24   images, text, sound or program instructions embodied in app-

1 lets or scripts. Examples of the content of individual web  
2 pages 212 are discussed below in connection with FIGS. 4-6.

3 FIG. 3 is a network diagram depicting an exemplary oper-  
4 ating environment of VCU 102. Generally, VCU 102 communicates  
5 with remote conference endpoints 302 over a circuit switched  
6 network 310, and with remote PCs 304 and 308 over LAN 130 and  
7 (optionally) over Internet 312. Remote conference endpoints  
8 302 may comprise, for example, videoconferencing systems capa-  
9 ble of generating and receiving both video and audio data. Al-  
10 ternatively, one or more remote conference endpoints 302 may  
11 comprise audio conferencing devices limited to communication  
12 of audio data only. Video and audio data is transmitted be-  
13 tween or among VCU 102 and remote conference endpoints 302  
14 over circuit switched network 310, which may comprise the pub-  
15 lic switched telephone network (PSTN). As discussed above, VCU  
16 102 is connected to circuit switched network 310 via ISDN in-  
17 terface 122 and ISDN lines 108. A multipoint control unit  
18 (MCU) or video bridge (not shown) may be coupled to circuit  
19 switched network 310 and used to combine and distribute video  
20 and audio data for multipoint conferences.

21 LAN 130, to which VCU 102 is connected via network inter-  
22 face 126 and network hub 128, will typically be an Ethernet  
23 network, but may alternatively comprise any suitable packet  
24 switched network of arbitrary topology and size. Remote PCs

1 304 are located at nodes of LAN 130. Other network-enabled de-  
2 vices may also be connected to LAN 130. An Internet gateway  
3 306 (or alternatively a router or bridge), coupled to LAN 130,  
4 allows communication between LAN-connected computers and de-  
5 vices (such as VCU 102 and remote PCs 304) and computers or  
6 devices (such as remote PCs 308) connected to Internet 312.

7 As is known in the network art, each computer or device  
8 connected to LAN 130 is assigned a unique IP address. Assign-  
9 ment of addresses may typically be performed by a dynamic host  
10 configuration protocol (DHCP) server located on LAN 130. Cer-  
11 tain LAN connected devices may also be given unique domain  
12 names by a system administrator to allow easier identification  
13 thereof. For example, VCU 102 may be given the domain name  
14 "vcu1.companyname.com". Name/address resolution is implemented  
15 by a domain name server located on LAN 130.

16 Remote PCs 304 and 308 comprise conventional personal  
17 computers or similar devices capable of executing a web  
18 browser, such as Internet Explorer or Netscape Navigator. As  
19 will be discussed in greater detail below, users of remote PCs  
20 are able to perform various functions in connection with VCU  
21 102 by pointing a browser to the URL corresponding to web  
22 server 210 of VCU 102.

23 The operation of the web-enabled features of VCU 102 may  
24 best be understood with reference to the exemplary web pages

1 depicted in FIGS. 4-6 and the flowcharts depicted in FIGS. 8  
2 and 9. FIG. 4 depicts an exemplary home page 400 of VCU 102. A  
3 user of a remote PC, such as remote PC 304 connected to VCU  
4 102 through LAN 130, accesses home page 400 by entering the  
5 URL of VCU 102 (e.g., http://vcu1.companyname.com) into loca-  
6 tion box 402 of a browser running on remote PC 304. The  
7 browser responsively sends a web page request to VCU 102 along  
8 LAN 130. The web page request is directed to web server 210,  
9 which in turn transmits home page 400 (encoded in HTML format)  
10 to remote PC 304. The browser receives and interprets home  
11 page 400 and causes it to be displayed to the user.

12 Home page 400 presents a set of options for further ac-  
13 tion by the user. The options are represented by text and/or  
14 graphics, and include embedded hypertext links referencing a  
15 corresponding web page. In the current example, home page 400  
16 provides a "Select a presentation" option 404, a "View a pres-  
17 entation" option 406, and a "System information and manage-  
18 ment" option 408. As will be discussed in further detail be-  
19 low, linking to "Select a presentation" option 404 allows the  
20 remote user to select a presentation file (comprising a plu-  
21 rality of slides) for transmission by VCU 102 to remote con-  
22 ference endpoints 302. Linking to "View a presentation" option  
23 406 allows the user of remote PC 304 to view presentation  
24 slides currently being transmitted by VCU 102. Finally, link-

1 ing to "System information and management" option 408 allows  
2 the user to remotely perform tasks in connection with VCU 102  
3 such as conference call placement and system diagnostics. This  
4 option is discussed below in connection with FIG. 5. The re-  
5 mote user conventionally selects a desired option by maneuver-  
6 ing the mouse pointer over the text and/or graphics represen-  
7 tative of the desired option and clicking the mouse button.

8 FIG. 5 is an exemplary web page 500 corresponding to  
9 "System information and management" option 408. In practice,  
10 selection of "System information and management" option of  
11 home page 400 causes the browser to send a request for corre-  
12 sponding web page 500 to web server 210 of VCU 102, and web  
13 server 210 responsively transmits web page 500 in HTML encoded  
14 format. Web page 500 displays an additional set of more spe-  
15 cific options, including a "Place phone call" option 502, a  
16 "System Diagnostics" option 504, and a "Set-Up and Configura-  
17 tion" option 506.

18 Selection of "place phone call" option 502 causes another  
19 web page to be retrieved from web server 210. This web page  
20 includes forms or dialog boxes wherein the user of remote PC  
21 304 is prompted to enter call parameters, such as the tele-  
22 phone number(s) of remote conference endpoint 302 and the de-  
23 sired connection speed. The call parameters entered by the  
24 user are subsequently transmitted to VCU 102 and passed to

1 conferencing application 206, which starts a conference call  
2 using the entered call parameters. "Place phone call" option  
3 502 may thus be advantageously employed to remotely initiate  
4 and configure conference calls, thereby avoiding the need for  
5 the conference participants (who may have little or no famili-  
6 arity with the operation of videoconferencing system 100) to  
7 do so themselves.

8 Selection of "System diagnostics" option 504 causes diag-  
9 nostics/management module 204 to execute one or more tests of  
10 VCU 102 components to verify their operation and identify any  
11 problems. Upon completion of the one or more tests, web server  
12 210 generates and transmits to remote PC 304 a web page dis-  
13 playing the test results. This option will be discussed fur-  
14 ther in connection with FIG. 9.

15 Finally, selection of "Set-up and configuration" option  
16 506 causes diagnostics/management module 204 to determine cur-  
17 rent values of a specified set of configuration parameters.  
18 These configuration parameters may include the following: sys-  
19 tem name, country, ISDN numbers, ISDN switch, and auto-answer  
20 status. The values of the parameters are then passed to web  
21 server 210, which generates and transmits a web page display-  
22 ing the parameter values. The web page may include forms or  
23 dialog boxes allowing the user to enter new configuration pa-

1 parameter values, which are subsequently conveyed to diagnostics/management module 204 and used to reconfigure VCU 102.

3 FIG. 6 is an exemplary web page 600 corresponding to "Select a presentation" option 404. As alluded to above, a user  
4 of a computer or device connected to VCU 102 over LAN 130, for  
5 example remote PC 306, may upload presentation files (typically in PowerPoint format) to VCU 102 for subsequent transmission  
6 to remote conference endpoints 302, as well as to  
7 other computers or devices connected to LAN 130 or Internet  
8 312. Responsive to selection of "select a presentation" option  
9 404, web server 210 transmits HTML-encoded web page 600, which  
10 includes a script or applet(s) for generating a presentation  
11 file selection window 602. The user selects a presentation by  
12 first specifying in box 604 the location of the presentation  
13 (for example, a folder on the hard drive of remote PC 306).  
14 Presentation file selection window 602 then displays names of  
15 presentation files 608 stored in the specified location. The  
16 user may then highlight the desired presentation file to select it and engage open button 606.

17 The selected presentation file, comprising a set of  
18 slides, is then transmitted to VCU 102 via LAN 130 (in accordance with a script or applet embedded in or referenced by web  
19 page 600). The presentation file is then directed to presentation engine 208, which converts the slides of the presentation

1 to a set of thumbnail images encoded in suitable format. The  
2 encoded thumbnail images are then added to the video data  
3 stream supplied to video I/O interface 120 such that the  
4 thumbnail images are displayed on video monitor 110.

5 FIG. 7 depicts a set of exemplary thumbnail images 700  
6 corresponding to presentation slides displayed on video moni-  
7 tor 110. A near videoconference participant may navigate  
8 through thumbnail images 700 by engaging user controls 134,  
9 such as the directional arrows on a remote control device.  
10 Upon selection of a particular thumbnail image 700, the par-  
11 ticipant may engage the "select" key on the remote control to  
12 cause the slide corresponding to the selected thumbnail image  
13 700 to be transmitted by VCU to remote conference endpoints  
14 302 for viewing by the remote conference participants.

15 FIG. 8 is a flowchart depicting the steps of a method for  
16 selecting presentations in accordance with the present inven-  
17 tion. In step 800, a computer connected to VCU 102, for exam-  
18 ple remote PC 304, transmits a request for presentation page  
19 600 to VCU 102. This request is initiated by the user clicking  
20 on "Select a presentation" option 404 of home page 400.

21 Next, web server 210, upon receipt of the web page re-  
22 quest, performs an optional authentication step 802 wherein it  
23 is determined if the user requesting presentation page 600 is  
24 authorized to do so. This step may be performed by sending an

1 authentication page having a dialog box prompting the user to  
2 enter a userid and/or a password. This information is then  
3 transmitted to web server 210, which checks the entered infor-  
4 mation against a list of authorized users. If it is determined  
5 that the user is not authorized to receive presentation page  
6 600, the method ends, step 804.

7 If it is determined that the user is authorized, web  
8 server 210 transmits presentation page 600 to remote PC 304,  
9 step 806. As discussed above in connection with FIG. 6, pres-  
10 entation page 600 includes or references a script or applet  
11 which causes a presentation selection window 602 to appear  
12 within the browser window of remote PC 304. The user then  
13 identifies the location and file name of the selected presen-  
14 tation by entering the appropriate information into presenta-  
15 tion selection window 602. The file containing the presenta-  
16 tion may reside, for example, on the hard drive of remote PC  
17 304.

18 When a presentation file has been identified, it is  
19 transmitted to VCU 102 and directed to presentation engine  
20 208, step 808. Presentation engine 208 then extracts the com-  
21 ponent slides of the transmitted presentation file and gener-  
22 ates thumbnail images, encoded in a suitable format, of each  
23 slide, step 810. The data encoding the thumbnail images is  
24 then inserted into the video data stream directed to video I/O

1 interface 118, and the thumbnail images are accordingly dis-  
2 played on video monitor 110, step 814. A near conference par-  
3 ticipant then selects a slide for transmission to remote con-  
4 ference endpoint 302 by navigating through the thumbnail im-  
5 ages using user controls 134. Upon selection of a slide, pres-  
6 entation engine 208 causes conferencing application 206 to  
7 transmit the corresponding image to remote conference endpoint  
8 302, step 816.

9 In step 818, it is determined if the near conference par-  
10 ticipant wishes to send another slide. If so, the method re-  
11 turns to step 816; if not, the method ends, step 820.

12 FIG. 9 depicts the steps of a method for remotely initi-  
13 ating diagnostic tests of VCU 102. In step 900, a computer  
14 connected to VCU 102, for example remote PC 304, transmits a  
15 request for a diagnostics web page to VCU 102. This request is  
16 initiated by the user clicking on "System diagnostics" option  
17 504 of system information and management page 500.

18 Next, web server 210, upon receipt of the web page re-  
19 quest, performs an optional authentication step 902 as de-  
20 scribed above in connection with the FIG. 8 method. If it is  
21 determined that the user is not authorized to receive presen-  
22 tation page 600, the method ends, step 904.

23 If it is determined in step 902 that the user is author-  
24 ized, diagnostics/management module 204 is caused to perform a

1 set of diagnostic tests to check the operation of VCU 102 and  
2 identify any operational problems, step 906. Examples of tests  
3 performed by diagnostics/management module 204 include testing  
4 of the audio components, near end communication loop, and far  
5 end communication loop. The test results obtained by diagnos-  
6 tics/management module 204 are then passed to web server 210,  
7 which generates a diagnostics web page incorporating the test  
8 results, step 908. The diagnostics web page is then transmit-  
9 ted to remote PC 304, step 910. The method then ends, step  
10 912.

11 It is appreciated that other techniques may be utilized  
12 to remotely manage VCU 102. For example, a Simple Network Man-  
13 agement Protocol (SNMP) agent may be installed at VCU 102 and  
14 configured to provide notification to a system administrator  
15 located on LAN 130 upon the occurrence of certain events, such  
16 as a malfunction of VCU 102. Other network-based methods for  
17 remotely managing VCU 102 through LAN 130 may occur to those  
18 of ordinary skill in the art and are considered to be within  
19 the scope of the present invention.

20 Examples set forth above describe accessing web pages 212  
21 through browsers running on remote PCs 306 and 308 connected  
22 to VCU 102 via LAN 130 and Internet 312. However, it is to be  
23 appreciated that web pages 212 may also be accessed and the  
24 corresponding functions performed through a browser running on

1 local PC 132, even in the absence of a connection between VCU  
2 102 and LAN 130.

3 It will be recognized by those skilled in the art that,  
4 while the invention has been described above in terms of pre-  
5 ferred embodiments, it is not limited thereto. Various fea-  
6 tures and aspects of the above described invention may be used  
7 individually or jointly. Further, although the invention has  
8 been described in the context of its implementation in a par-  
9 ticular environment and for particular applications, e.g.,  
10 videoconferencing applications, those skilled in the art will  
11 recognize that its usefulness is not limited thereto and that  
12 the present invention can be beneficially utilized in any num-  
13 ber of environments and implementations. Accordingly, the  
14 claims set forth below should be construed in view of the full  
15 breadth and spirit of the invention as disclosed herein.